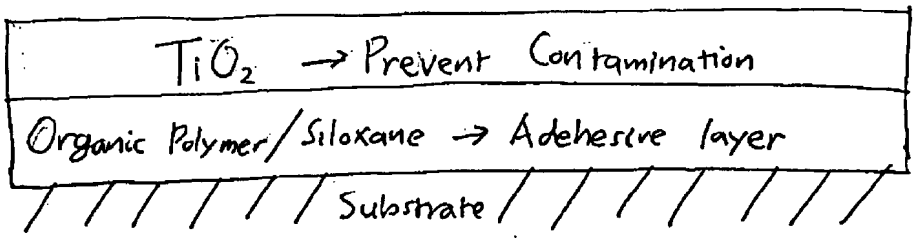
anticipated by Aubay et. al. (US6,905,814, Aubay reference hereinafter).

Claims 2, 4, 7 and 11 are compared with Aubay reference.

Aubay reference discloses a film-forming titanium dioxide dispersion for cleaning and disinfecting. $TiO_2$ is used for preventing contamination, which is one of the functions of an ordinary photo catalyst.

The mechanism of using $TiO_2$ in Aubay reference is illustrated below.




As illustrated in the above, titanium dioxide is coated on the outermost surface.

The reasons of not directly coating titanium dioxide are that it is not easy to coat titanium dioxide directly onto the substrate; and it peels easily even though it has been coated; and even if it functions for a long time without peeling, the substrate itself is decomposed by photo catalyst. Therefore, organic polymer or organic siloxane is used as bonding material. That is, simple titanium dioxide dispersion without organic polymer material cannot perform the intended functions of the Aubay reference. Thus, the Aubay reference discloses a mixture of titanium dioxide dispersion and organic polymer.

If the mixture is directly spayed on the leaf surface of a plant for the reason that the particle sizes are similar, stomatas may be clogged and a big obstacle for plant growth may be created, and the plant will eventually die.

Generally, titanium dioxide is bonded to the surface of an object and photo catalyst effect of titanium dioxide is used for disinfection, decomposing organic materials, etc.

It is obvious that when titanium dioxide is exposed to ultraviolet light, it forms

thereby preventing contaminant from adhering.

The present invention does not adhere a composition including nano particles of titanium dioxide to the leaf surface of a plant, but makes the composition be absorbed to the leaf surface for promoting photosynthesis by promoting electron transport in the light-dependent reaction.

If, as in the prior art, composition including titanium dioxide is sprayed and adhered to the leaf surface of the plant, following problems occur. If too much amount is applied, stomatas in the leaf are clogged, and photosynthesis is blocked and the plant dies. If too small amount is applied, intended effect is not obtained, and the composition is washed out by rain and wind. Several repetitive applying might obtain only trivial effects. Even if adequate amount is sprayed, the applied composition might decompose organic material on the leaf surface and promote generation of CO2 and thus promote photosynthesis. However, this effect is very unlikely since only tiny amount of organic material exists on the leaf surface, and only disinfection effect is expected.

As explained above, prior art used titanium dioxide by adhering it on the surface of an object, and there was no invention in which titanium dioxide is absorbed in the leaf of a plant like the present invention.

In order to be absorbed to the leaf surface, the particle must have a suitable size, and the size is 3 ~ 200 nm.

Titanium dioxide has coherent property, and there is a problem that initially nano-sized particles cohere one another and becomes micro-size when the composition is manufactured. Even though known dispersions are used to keep nano-size in the composition, when it is diluted with water in the actual application, the particles cannot keep dispersed state, and cohere and precipitate. Cohered particles cannot be absorbed to the leaf surface and adhered to the surface. These clog the stomatas and block ultraviolet rays and may even clog the nozzle thereby hindering the spraying itself.

When in actual application, the composition is diluted with water by hundreds or tends of thousands, and the particles are cohered and precipitated. Keeping dispersed state is difficult and keeping nano size is more difficult. (Prior art did not need to address dispersion and keeping nano size since the composition was used to adhesion purpose.)

The present invention adds surfactant to facilitate dispersion, and adjusts pH with organic or inorganic acid in order to prevent rapid precipitation of the component. (In the embodiment, pH was adjusted as 0.5). In this way, not only in the state of undiluted composition, but also in the diluted state (1 ~ 1,000 ppm), precipitation does not occur, and colloid state with nano-sized particles is maintained so that titanium dioxide is absorbed to the leaf surface of the plant.

The surface of titanium dioxide particles is changed by the pH adjusting, thus the particles do not cohere, and are not precipitated, and dispersed state is kept. This features are new.

In this way, nano size is kept and nonprecipitated colloid composition is rapidly absorbed to the plant so that only one application can obtain the intended result without regard to external factors such as weather. The result of the present invention is possible because titanium oxide is absorbed not adhered to the plant.

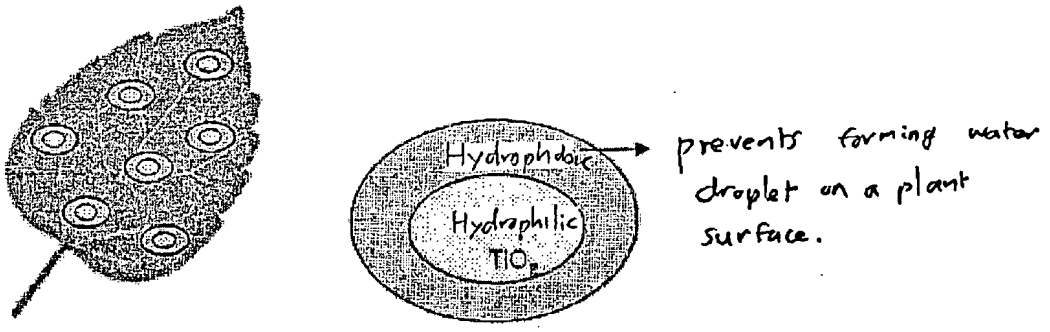
As explained above, the invention claimed by the claims 2, 4, 7 and 11 is different from Aubay reference in their use, composition and advantageous effects. Thus, the present invention is not anticipated by Aubay reference.

II. Claims 2, 4, 7 -10 were again rejected under 35 U.S.C. 103(a) as being unpatentable over Glenn et al. (US 6,235,683, Glenn reference hereinafter).

The differences of the invention claimed in the claims from the disclosure of the cited reference are explained below.

Glenn reference discloses a particulate material for preventing formation of ice by enhancing supercooling of a plant to temperatures below about -2 degree Celsius and thereby preventing water from freezing even though the temperature is below 0 degree

Celsius. The particulate material comprises a hydrophilic core and a hydrophobic outer surface and the hydrophilic core comprises at least one of calcium carbonate, mica, talc, kaolin, bentonite, pyrophillite, dolomite, silica, feldspar, sand, quartz, chalk, limestone, diatomaceous earth, baryte, aluminum trihydrate, and titanium dioxide.




Titanium dioxide is not essential since other material can also be used as the hydrophilic core.

The Glenn reference is related to a method of preventing cold-weather damage and freezing damage of a plant by adhering particulate materials that has a hydrophilic core and a hydrophobic outer surface to the surface of the plant, so that the hydrophobic outer surface prevents forming of water droplet on a plant surface. Titanium dioxide particles do not directly affect to the plant.

The use of Glenn reference is prevention of cold-weather damage and the freezing damage of plants. The use of present application is promotion of plant growth and hence completely different from that of Glenn reference.

If titanium dioxide particles that have a size less than 100 μm disclosed in Glenn reference is used to make the composition of similar to that of the present invention, in manufacturing step, titanium dioxide particles cohere and become larger in size and precipitation occurs; and when the particles are diluted with water and applied to the leaf surface as in the present invention, as soon as the composition is diluted with water, cohesion of titanium dioxide particles and precipitation occur. Even the nozzle may be clogged, and spraying onto the plant will not result in absorption, not even adhesion.

As explained above with reference to Aubay reference,

not adhere a composition including nano particles of titanium dioxide to the leaf surface of a plant, but makes the composition be absorbed to the leaf surface for promoting photosynthesis by promoting electron transport in the light-dependent reaction.

As explained above, prior art used titanium dioxide by adhering it on the surface of an object, and there was no invention in which titanium dioxide is absorbed in the leaf of a plant for directly promoting photosynthesis like the present invention.

In order to be absorbed to the leaf surface, the particle must have a suitable size, and the size is 3 ~ 200 nm.

Titanium dioxide has coherent property, and there is a problem that initially nano-sized particles cohere one another and becomes micro-size when the composition is manufactured. Even though known dispersions are used to keep nano-size in the composition, when it is diluted with water in the actual application, the particles cannot keep dispersed state, and cohere and precipitate. Cohered particles cannot be absorbed to the leaf surface and adhered to the surface. These clog the stomatas and block ultraviolet rays and may even clog the nozzle thereby hindering the spraying itself.

When in actual application, the composition is diluted with water by hundreds or tends of thousands, and the particles are cohered and precipitated. Keeping dispersed state is difficult and keeping nano size is more difficult. (Prior art did not need to address dispersion and keeping nano size since the composition was used to adhesion purpose.)

The present invention adds surfactant to facilitate dispersion, and adjusts pH with organic or inorganic acid in order to prevent rapid precipitation of the component. (In the embodiment, pH was adjusted as 0.5). In this way, not only in the state of undiluted composition, but also in the diluted state (1 ~ 1,000 ppm), precipitation does not occur, and colloid state with nano-sized particles is maintained so that titanium dioxide is absorbed to the leaf surface of the plant.

The surface of titanium dioxide particles is changed by the pH adjusting, thus the particles do not cohere, and are not precipitated, and dispersed state is kept. This features

are new.

In this way, nano size is kept and nonprecipitated colloid composition is rapidly absorbed to the plant so that only one application can obtain the intended result without regard to external factors such as weather. The result of the present invention is possible because titanium oxide is absorbed not adhered to the plant.

Therefore, the present invention is different and nor implied from the disclosure of Glenn reference in their use, composition and advantageous effects.

## CONCLUSION

The applicant believes that the rejections were obviated by the amendment of claims and the above remarks, and the application is now in condition for allowance: therefore, reexamination, reconsideration and allowance of the claims are respectively requested. If there are any additional comments or requirements from the examination, the applicant asks for a non-final office action.

The Commissioner is hereby authorized to charge payment of any additional fees associated with this communication, or credit any over-payment to Deposit Account No. 16-0310.

Very truly yours,
Park Law Firm

Dated: April 30, 2007

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